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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention is pierced and relates to the manufacture approach of the magnetic steel sheet for adhesion iron cores which pastes up with pressurization and heating (heating sticking by pressure), and is used after processing of a shear, press working of sheet metal, etc
[0002]
[Description of the Prior Art] The iron core generally used for electrical machinery and apparatus, such as a motor and a transformer, is manufactured by carrying out the laminating of the magnetic steel sheet with which the insulating coat was formed in the front face in order to reduce eddy current loss, and subsequently fixing it with welding, caulking, or adhesives in a predetermined configuration, punching or after carrying out shearing.
[0003] However, by the fixing approach by welding or caulking, when an insulating coat is destroyed and an iron core short-circuits electrically, the increment in eddy current loss is caused, or there is mechanical or a fault of being easy to produce degradation of magnetic properties by thermal strain. Moreover, by the fixing approach by adhesives, it is necessary to apply adhesives to punching or the steel plate which carried out shearing for every sheet, this activity takes great time amount and a great effort, and there is a problem that working efficiency is inferior.
[0004] The magnetic steel sheet for adhesion iron cores which enabled it to skip the spreading process of the above-mentioned adhesives is known for forming beforehand the bonded type insulation coat from which an adhesion operation is acquired by pressurization and heating (heating sticking by pressure) on the surface of a magnetic steel sheet to such a conventional technique, and the following techniques are proposed about this.
(1) The surface coating steel plate for layer-built iron cores which made the steel plate front face apply and dry the processing liquid which formed the thermoplastics and thermosetting resin of a solvent mold into the water emulsion with the emulsifier is shown in JP,52-8988,B.
[0005] (2) A glass transition point uses the thermoplastic acrylic resin (emulsion A) epoxy resin (emulsion B) amine system epoxy resin curing agent and a specific membrane formation assistant 60 degrees C or more as a principal component, the drainage system bonded type pre-insulation constituent whose resin solid content weight ratios of a component (A) and a component (B) are (A)/(B) =70 / 30 - 95/5 is applied to a steel plate front face, and the dried magnetic steel sheet for adhesion iron cores is shown in the patent No. 2574698 official report.
[0006] (3) In JP,7-308990,A The acrylic emulsion resin with which a glass transition point has in a molecule an epoxy group and the functional group in which a reaction is possible at 80-130 degrees C (A), The epoxy resin emulsion (B) the melting point or whose softening temperature is 70-140 degrees C is used as a principal component. It has the mixed resin coat whose resin solid content weight ratios of a component (A) and a component (B) are (A)/(B) =95 / 5 - 70/30. The surface coating magnetic steel sheet for heating adhesion which made the rate of gelation of this mixed resin coat 10 - 90% of the

weight of the range and in which bond strength sufficient also in the bottom of hot environments 150 degrees C or more is shown is shown.
[0007] (4) The drainage system heat bonded type covering constituent excellent in the elevated-temperature bond strength which a glass transition point becomes from a thermoplastics emulsion, an epoxy resin emulsion, and aquosity phenol resin 80 degrees C or more is shown in JP,7-268307,A.
(5) the manufacture approach of few surface coating magnetic steel sheets of an odor for adhesion be show in the patent No. 2529053 official report at the time of the spreading desiccation characterize desiccation by make a steel plate side apply and dry the mixed liquor which use the acrylic resin emulsion which do not contain a nitrogen atom and a sulfur atom in a monomer , an epoxy resin emulsion and an epoxy resin , the acid anhydride system epoxy curing agent that react , or the initial condensate of methylol radical content as a principal component , and aluminum dies casting .
[0008] (6) the mixed liquor which use as a principal component the acrylic modified epoxy resin emulsion (what be emulsion-ized after having made it react with acrylic resin after blending a latency curing agent with an epoxy resin, and covering the perimeter of an epoxy resin and a latency curing agent) which blended the latency curing agent with the steel plate front face beforehand be apply, it excel in the coating stability stability be characterize by the ability to be burn on an imperfect state, and the manufacture approach of few surface coating magnetic steel sheets of the odor at the time of spreading desiccation for adhesion show in the patent No. 2613725 official report.
[0009]
[Problem(s) to be Solved by the Invention] However, there are the following problems in the surface coating magnetic steel sheet for adhesion iron cores obtained by these conventional techniques. Since, as for the surface coating steel plate of the above (1), about 40% or more of the base resin in a coat consists of thermoplastics, although the bond strength in ordinary temperature is obtained to some extent, under hot environments, softening of thermoplastics arises and the bond strength of sufficient level is not obtained. Moreover, since a lot of emulsifiers are used for aquosity-ization, it is inferior also to corrosion resistance.
[0010] Since 70% or more of the base resin in a coat consists of thermoplastics also in the magnetic steel sheet for adhesion iron cores of the above (2), although the bond strength in ordinary temperature is obtained to some extent, under hot environments, softening of thermoplastics arises and the bond strength of sufficient level is not obtained. As for the surface coating magnetic steel sheet of the above (3), in order to emulsion-ize by the compulsive emulsifying method which used the emulsifier, an emulsifier remains in a coat, and in order that the hydrophilic group contained for the emulsifier component may cause a moisture absorption operation, an epoxy resin emulsion has a fault inferior to corrosion resistance, so that clearly from the example, although the bond strength under hot environments 150 degrees C or more improves.
[0011] Although bond strength with the bonded type insulation coat sufficient in the case of the comparatively thick thickness of 10-micrometer (desiccation thickness) extent obtained with the drainage system heat bonded type covering constituent of the above (4) is obtained, bond strength sufficient in the case of the comparatively thin thickness not more than 5-6 micrometers (desiccation thickness) or it is not obtained. Although generating of the odor [magnetic steel sheet / which is obtained by the manufacture approach of the above (5) / surface coating] at the time of spreading desiccation and aluminum dies casting improves, the bond strength of sufficient level under hot environments is not obtained. Although the surface coating magnetic steel sheet of the above (6) is excellent in the bond strength in ordinary temperature, and the bond strength after a mothball, it is inferior to the bond strength under hot environments.
[0012] Therefore, after the purpose of this invention solves the technical problem of such a conventional technique and heating sticking by pressure is carried out as an iron core ingredient, it is in ordinary temperature offering the manufacture approach of the magnetic steel sheet for adhesion iron cores of having sufficient bond strength and having excelled also in the blocking resistance as a magnetic steel sheet for adhesion iron cores, and corrosion resistance further also under about 150-degree C hot environments from the first.

[0013]
[Means for Solving the Problem] this invention persons repeated examination wholeheartedly about the relation between the bond strength under the coat configuration of the magnetic steel sheet for adhesion iron cores and its manufacture condition, ordinary temperature, and hot environments, corrosion resistance, blocking resistance, etc., consequently acquired the following knowledge.
1) By using drainage system epoxy system resin as a principal component of the base resin which constitutes a coating constituent, the outstanding bond strength under ordinary temperature and hot environments can be obtained. When the gestalt of the base resin in the inside of a coating constituent has big effect on the engine performance of the magnetic steel sheet for adhesion iron cores and sets mean particle diameter of the epoxy system resin in the inside of a coating constituent to 0.05-2 micrometers especially, the especially excellent bond strength, good corrosion resistance, and blocking resistance are acquired.
[0014] 2) As an epoxy resin curing agent which constitutes a coating constituent, elevated-temperature bond strength can be effectively raised by using especially phenol resin, without degrading blocking resistance and corrosion resistance. Furthermore, elevated-temperature bond strength improves further by carrying out compound addition of phenol resin and the latency curing agent as a curing agent.
[0015] This invention was made based on such knowledge, and the description is as follows.
[1] the manufacture approach of the magnetic steel sheet for adhesion iron cores that the curing agent be excellent in the bond strength , corrosion resistance , and blocking resistance of 1 - 40 weight section to which it be characterize by the ability to be burn so that the drainage system coating constituent with which it be blended comparatively (solid content comparatively) may be apply so that it may be set to 1.0-12 micrometers by desiccation thickness at least at one side of a magnetic steel sheet , and it may become 100-300 degrees C by attainment board temperature as a resinous principle to the epoxy system resin 100 weight section whose mean particle diameter be 0.05-2 micrometers .
[0016] [2] The manufacture approach of the magnetic steel sheet for adhesion iron cores of having excelled in the bond strength, corrosion resistance, and blocking resistance which are characterized by some curing agents [at least] being phenol resin in the manufacture approach of the above [1].
[3] The manufacture approach of the magnetic steel sheet for adhesion iron cores of having excelled in the bond strength, corrosion resistance, and blocking resistance which are characterized by the loadings of the latency curing agent to the phenol resin 100 weight section being the 2 - 200 weight section at a rate of solid content by a curing agent consisting of phenol resin and a latency curing agent in the above [1] or the manufacture approach of [2].
[0017]
[Embodiment of the Invention] Hereafter, the detail of this invention is explained with the reason for limitation. The object of manufacture by this invention method is a magnetic steel sheet for adhesion iron cores which has the insulating coat (bonded type insulation coat) from which an adhesion operation is acquired by pressurizing and heating (heating sticking by pressure). The steel plate used as the substrate which should form a bonded type insulation coat in this invention is a magnetic steel sheet for iron cores used for electrical machinery and apparatus, such as a motor and a transformer. As such a magnetic steel sheet, although a non-oriented magnetic steel sheet or a grain oriented magnetic steel sheet is common, the steel plate which a mild steel plate, a stainless steel plate, other special steel plates, etc. are sufficient as, and turns into a substrate besides this is not limited. The effectiveness of this invention can be acquired even when which [these] steel plate is used as a substrate.
[0018] Moreover, what gave one sort of surface treatment, such as an insulating coat of zinc system plating or other metal plating coats, a chemical conversion coat, an inorganic system, or inorganic-organic system, or two sorts or more beforehand to the front face is sufficient as the magnetic steel sheet used as a substrate, and when the front face of a magnetic steel sheet has these surface treatment coat in this invention, it shall say the front face of the maximum upper coat.
[0019] Although a coat is formed by the manufacture approach of this invention by applying to the front face of the above-mentioned magnetic steel sheet the drainage system coating constituent which uses drainage system resin and a curing agent as a principal component, and being burned on it, the epoxy

system resin whose mean particle diameter is 0.05-2 micrometers as said drainage system resin is used. First, as a result of this invention persons' considering the relation of the various drainage system resin and bond strength used as the base resin of a drainage system coating constituent, it turned out that epoxy system resin is the optimal as base resin of a drainage system coating constituent.

[0020] Although the bond strength in ordinary temperature is obtained when acrylic resin and urethane resin are used as base resin of a drainage system coating constituent as shown in coating constituent No.38 of the example mentioned later, and the example of a comparison using No.39, sufficient bond strength under hot environments is not obtained. It is thought that it is because it will become easy to dissociate a urethane bond and sufficient elevated-temperature bond strength will no longer be obtained for this reason if this becomes that in which softening of a coat arose at the elevated temperature since acrylic resin was thermoplastics, for this reason elevated-temperature bond strength was inferior and urethane resin becomes an elevated temperature.

[0021] On the other hand, both the coats that consist of epoxy system resin and its curing agent show the bond strength which was excellent under ordinary temperature and hot environments. Epoxy system resin and a curing agent form the three-dimension structure of cross linkage by heating sticking by pressure at the time of iron core manufacture, it is hard to produce softening of a coat by this structure of cross linkage also under hot environments, and this is considered to be because for the elevated-temperature bond strength which was excellent with this to be obtained.

[0022] Moreover, it is necessary to use that whose mean particle diameter is 0.05-2 micrometers as epoxy system resin, and the coat which was excellent in bond strength, blocking resistance, and corrosion resistance all for the first time with this can be obtained. That is, even if the mean particle diameter of the epoxy system resin particle in a coating constituent exceeds 2 micrometers, at least less than 0.05 micrometers of coats to which bond strength, blocking resistance, and corrosion resistance all are satisfied are not obtained. Moreover, the more desirable mean particle diameter of the viewpoint of acquiring these properties with sufficient balance to an epoxy system resin particle is 0.05-1 micrometer, and the bond strength, blocking resistance, and corrosion resistance which were excellent especially by setting mean particle diameter to 0.1-0.5 micrometers further are acquired.

[0023] The epoxy system resin used by this invention is the thing of the shape of a liquid or a solid-state in ordinary temperature, and various epoxy resins, such as the bisphenol A mold, a bisphenol female mold, the bisphenol A D mold, a naphthalene mold, a phenol novolak mold, an orthochromatic cresol novolak mold, a glycidyl ester mold, and an alicycle mold, are mentioned to the epoxy resin and concrete target which have two or more epoxy groups in a monomer.

[0024] Moreover, the emulsion mold epoxy resin obtained by performing compulsive emulsification under existence of an emulsifier as a gestalt of a drainage system epoxy resin. Although there are an aqueous solution type epoxy resin aquosity-ized by neutralizing a part of carboxyl group [at least] and a moisture powder type epoxy resin using the protective colloid of acrylic resin after making polybasic acid and an epoxy resin react In this invention, as long as it can use any drainage system epoxy resin and the mean particle diameter of epoxy system resin is within the limits of the above, it can adhere to these gestalten and the effectiveness of this invention can be acquired that there is nothing. However, when severe corrosion resistance is required especially, it is most desirable to use moisture powder type epoxy system resin.

[0025] The epoxy resin curing agent generally used can be used for the curing agent used for a coating constituent. For example, aliphatic series polyamine, alicycle group polyamine, aromatic series polyamine, polyamine system curing agent; 1 functionality acid anhydrides (phthalic anhydride --), such as polyamide polyamine and denaturation polyamine Hexahydro phthalic anhydride, methyl cyclohexene-dicarboxylic anhydride, methyl hexahydro phthalic anhydride, 2 functionality acid anhydrides (pyromellitic dianhydride --), such as an anhydrous methyl NAJIKKU acid and anhydrous chlorendic acid A benzophenone tetracarboxylic acid anhydride, an ethylene glycol screw (anhydro TORIMETO), free-acid acid anhydrides (trimellitic anhydride --), such as a methyl cyclohexene tetracarboxylic acid anhydride the Pori azelaic-acid anhydride etc. -- etc. -- acid-anhydride system curing agent; [like] -- at least one sort chosen from initial condensate [of methylol radical content];

latency curing agents, such as a novolak mold or resol mold phenol resin, a urea resin, and melamine resin, etc. can be used.

[0026] Let the loadings of the curing agent in a coating constituent be 1 - 40 weight section to the epoxy system resin 100 weight section at a rate of solid content. Hardening with the loadings of a curing agent sufficient at the time of heating sticking by pressure in under 1 weight section is not performed, but it is inferior to bond strength. Moreover, if the loadings of a curing agent exceed 40 weight sections, a coating constituent will thicken, or film formation nature worsens, and, for this reason, it is inferior to corrosion resistance and bond strength.

[0027] Moreover, since the bond strength under hot environments improves remarkably especially as a curing agent when phenol resin is used, it is desirable. This is considered to be for the thermal resistance of a coat to improve by introducing the benzene ring into a coat. As this phenol resin, the condensation reaction of phenols and formaldehyde, such as a phenol and bisphenol A, can be carried out under existence of a reaction catalyst, and the resol mold phenol resin which introduced the methylol radical can be mentioned.

[0028] Moreover, the bond strength of a coat improves further by carrying out compound addition of phenol resin and the latency curing agent at a specific rate. That is, compound addition of phenol resin and the latency curing agent is carried out as a curing agent, and bond strength improves the loadings of a latency curing agent former to the phenol resin 100 weight section the 2 - 200 weight section and by considering as the 3 - 100 weight section preferably especially at a rate of solid content

[0029] In order to investigate the proper range of the loadings of the latency curing agent at the time of carrying out compound addition of phenol resin and the latency curing agent, the front face of the magnetic steel sheet of 0.5mm of board thickness -- epoxy system resin (base resin No.4 [given in Table 1]): -- the 100 weight sections (solid content) -- Phenol resin (phenol resin given in Table 2) : It considers as 5 weight sections (solid content). The drainage system coating constituent into which the loadings (solid content) of the latency curing agent (latency curing agent given in Table 2) to the phenol resin 100 weight section were changed is applied so that it may become 6 micrometers of desiccation thickness. By the ability being burned at 200 degrees C of attainment board temperature, the magnetic steel sheet for adhesion iron cores was created, and the effect the loadings of a latency curing agent affect elevated-temperature bond strength (the appraisal method of a publication estimated this elevated-temperature bond strength in the example mentioned later) was investigated.

[0030] The result is shown in drawing 1 . According to this drawing, even if the loadings of the latency curing agent to the phenol resin 100 weight section exceed the 200 weight sections under in 2 weight sections, the remarkable elevated-temperature bond strength by compound addition of phenol resin and a latency curing agent is not obtained. Moreover, the elevated-temperature bond strength in which the loadings of the latency curing agent to the phenol resin 100 weight section were most excellent in the range of the 3 - 100 weight section especially is obtained.

[0031] As a latency curing agent used by this invention, a dicyandiamide, a melamine, Organic-acid dihydrazide, amine imide, ketimine, the 3rd amine salt, an imidazole salt, 3 boron-fluoride amine salt, a microcapsule mold-curing agent (a curing agent is enclosed into the microcapsule formed from casein etc.) A microcapsule is torn by heating and pressurization and a thing, a molecular-sieve mold-curing agent (what the curing agent was made to stick to the front face of an adsorbent compound, emits an admolecule with heating, and carries out a hardening reaction with resin), etc. which carry out a hardening reaction with resin are mentioned.

[0032] Although the coating constituent used by this invention uses as a principal component the base resin and the epoxy resin curing agent which consist of a specific drainage system epoxy resin mentioned above It does not bar that other base resinous principles are contained in part in a coating constituent in addition to the above-mentioned base resinous principle. For example, acrylic resin, polyurethane system resin, polyamide system resin, Polyimide system resin, polyester system resin, SHIRI cone system resin, fluororesin, Polyethylene, synthetic resin like polypropylene, nylon, police RUFAIDO, nitrile rubber, chloroprene rubber, an elastomer like a polyvinyl formal, etc. may be contained 35 or less % of the weight at a rate in the resinous principle of a coating constituent.

Moreover, it is also possible to blend one or more sorts, such as rust-proofing additives, such as oxide particles, such as a silica and an alumina, conductive matter, and a poorly soluble chromate, a color pigment, coloring colors (for example, a condensed multi-ring system organic pigment, a phthalocyanine system organic pigment, etc.) (for example, an azo system color, azo system metal complex dye, etc.), a membrane formation assistant, a dispersibility improver, and a defoaming agent, in addition to this.

[0033] Although the above-mentioned coating constituent is applied on the surface of a magnetic steel sheet and the coat for laminating adhesion is formed by the ability being burned in the manufacturing method of this invention, the coat thickness may be 1.0-12 micrometers by desiccation thickness. Less than 1.0 micrometers of bond strength are [coat thickness] insufficient, and since bond strength is not only saturated, but a space factor will fall on the other hand if coat thickness exceeds 12 micrometers, it is not desirable. More desirable coat thickness is 3 micrometers - 7 micrometers from a viewpoint of such bond strength and a space factor. The approach of applying a coating constituent to a steel plate side is arbitrary. Usually, although applied by the roll coater method, after applying with dip coating or a spray method, it is also possible to adjust coverage by the Ayr knife method or the roll extracting method.

[0034] Moreover, baking finish after applying a coating constituent can be performed using an air-heating furnace, a high-frequency-induction-heating furnace, an infrared furnace, etc. Stoving temperature is made into 100-300 degrees C by attainment board temperature. Since hardening of the coat before attainment board temperature carries out heating sticking by pressure at less than 100 degrees C for iron core manufacture is inadequate, corrosion resistance and blocking resistance are inferior. On the other hand, since hardening of the coat before heating sticking by pressure progresses too much and a coat stops producing sufficient softening melting at the time of heating sticking by pressure when attainment board temperature exceeds 300 degrees C, the interface of coats does not melt together, consequently bond strength becomes what was inferior. More desirable stoving temperature is 130-230 degrees C, and can acquire the bond strength which was excellent especially by this, corrosion resistance, and blocking resistance from such a viewpoint.

[0035] Although especially the programming rate at the time of baking finish is not limited, 3-80 degrees C / sec extent is desirable. Since the manufacture effectiveness of a steel plate is bad at under 3 degrees C / sec, if a programming rate, on the other hand, exceeds 80 degrees C/sec preferably, a possibility that a support may arise will be in a paint film, and a paint film appearance will tend to deteriorate.

[0036]

[Example] After applying a coating constituent to the magnetic steel sheet of 0.5mm of board thickness by the roll coater, baking finish was carried out, the magnetic steel sheet for adhesion iron cores was manufactured, and the bond strength of the obtained magnetic steel sheet for adhesion iron cores, blocking resistance, and corrosion resistance were evaluated. The result of the manufacture conditions (stoving temperature and desiccation thickness) of the magnetic steel sheet for adhesion iron cores and a performance evaluation is shown [a curing agent] for the presentation of a coating constituent in Table 2 in Table 3 - 5 at Table 6 - 10 as well as [presentation / of the base resin used for the coating constituent] Table 1. The preparation of a coating constituent and the approach of each performance evaluation of the magnetic steel sheet for adhesion iron cores are shown below.

[0037] The curing agent shown in the base resin (epoxy system resin) shown in [adjustment of coating constituent] table 1 and Table 2 was used, and the coating constituent of No.1-No.37 which mixes and agitates these and is shown in Table 3 - 5 was obtained. All the rates of the nonvolatile matter in these coatings constituent were made into 20wt(s)%. Moreover, the acrylic resin emulsion of No.38 and the urethane resin emulsion of No.39 which are shown in Table 5 are obtained by the following.

(a) Acrylic resin emulsion : the emulsion polymerization of the monomer mixture which consists of the methyl methacrylate 90 weight section, the styrene 15 weight section, the acrylic-acid 10 weight section, and the ethyl acrylate 10 weight section was underwater carried out with the conventional method, and the acrylic resin emulsion was created.

(b) Urethane resin emulsion : "ADEKABONDAITA HUX-240" by Asahi Denka Kogyo K.K. was used.

[0038] [Performance evaluation of the magnetic steel sheet for adhesion iron cores] (a) Heating sticking by pressure of the coat forming faces was carried out by the temperature up pattern shown in drawing 2 in superposition and the condition of having pressurized by pressure 10 kgf/cm2 so that the superposition section might be set to 25mmx12.5mm in the magnetic steel sheet for adhesion iron cores disconnected in room-temperature-gluing on-the-strength 25mmx50mm size. Tension was estimated under the ordinary temperature ambient atmosphere, maximum load until it destroys was measured and the tension tester estimated bond strength for this with the tension shear strength which broke this maximum load by the shear plane product (adhesion area). A valuation basis is shown below.
O Two or more two or more :160 kgf/cmO+:140 kgf/cm, less than [160 kgf/cm2] O : Two or more 120 kgf/cm, two or more less than two 140 kgf/cm** :100 kgf/cm, less than [120 kgf/cm2] x : Less than two 100 kgf/cm [0039] (b) It created by the same approach as the evaluation trial of the room-temperature-gluing reinforcement by the elevated-temperature bond strength above (a), and tension was estimated under 150-degree-C ambient atmosphere, maximum load until it destroys was measured and the tension tester estimated bond strength for the sample which carried out heating sticking by pressure with the tension shear strength which broke this maximum load by the shear plane product (adhesion area). A valuation basis is shown below.
O Two or more two or more :80 kgf/cmO+:60 kgf/cm, less than [80 kgf/cm2] O : Two or more 40 kgf/cm, two or more less than two 60 kgf/cm** :20 kgf/cm, less than [40 kgf/cm2] x : Less than two 20 kgf/cm [0040] (c) The coat forming faces of the magnetic steel sheet for adhesion iron cores disconnected in blocking resistance 20mmx20mm size were pressurized by superposition and welding-pressure 250 kgf/cm2, and the existence of the blocking after leaving it under 50-degree-C ambient atmosphere for 24 hours was investigated. A valuation basis is shown below.
O :-blocking-less x : those with blocking [0041] (d) The corrosion-resistant salt spray test was performed and the rate of rust generating area of 24 hours after estimated. A valuation basis is shown below.
O 10% or more of rates of less than 10% [of :rates of rust generating area] O:rust generating area, 25% or more of rates of less than 25%**:rust generating area, less than [50%] x : 50% or more of rates of rust generating area [0042]
[Table 1]

[ベース樹脂]

No.	形態	エポキシ樹脂の平均粒子径 (μm)
1	水分散型エポキシ樹脂	0.03
2	水分散型エポキシ樹脂	0.05
3	水分散型エポキシ樹脂	0.1
4	水分散型エポキシ樹脂	0.2
5	水分散型エポキシ樹脂	0.3
6	水分散型エポキシ樹脂	0.5
7	水分散型エポキシ樹脂	1.0
8	水分散型エポキシ樹脂	2
9	水分散型エポキシ樹脂	3
10	強制乳化型エポキシ樹脂	0.5

注) 下線を付した数値が本発明範囲外

[0043]
[Table 2]

表 2 [硬化剤]

フェノール樹脂	ビスフェノールAレゾール型フェノール樹脂 （ビスフェノールA：平均1．8分子） （ビスフェノールA1分子当りのメチロール基：平均3．1個）
メラミン樹脂A	三井サイテック㈱製 "サイメル325"
メラミン樹脂B	三井サイテック㈱製の "サイメル703"
ブロックイソシアネート	第一工業製薬㈱製の "エラストロンBN－27"
潜在性硬化剤	日本エヌエスシー㈱製の "エポルジョンHA50"
尿素樹脂	三和ケミカル㈱製の "ニカラックMS－20U"

[0044]
[Table 3]

表 3 [塗料組成物]

No.	ベース樹脂		硬化剤 (1)		硬化剤 (2)		
	種類 *1	添加量 *2	種類 *3	添加量 *2	種類 *3	添加量 *2	*4
1	1	100	フェノール樹脂	15	—	—	—
2	2	100	フェノール樹脂	15	—	—	—
3	3	100	フェノール樹脂	15	—	—	—
4	4	100	フェノール樹脂	15	—	—	—
5	5	100	フェノール樹脂	15	—	—	—
6	6	100	フェノール樹脂	15	—	—	—
7	7	100	フェノール樹脂	15	—	—	—
8	8	100	フェノール樹脂	15	—	—	—
9	9	100	フェノール樹脂	15	—	—	—
10	10	100	フェノール樹脂	15	—	—	—
11	4	100	—	0	—	—	—
12	4	100	フェノール樹脂	1	—	—	—
13	4	100	フェノール樹脂	3	—	—	—
14	4	100	フェノール樹脂	5	—	—	—
15	4	100	フェノール樹脂	10	—	—	—

*1：表1に記載のベース樹脂No.
*2：重量部（固形分）
*3：表2に記載の硬化剤の種類
*4：フェノール樹脂100重量部（固形分）に対する潜在性硬化剤の重量部（固形分）
注）下線を付した符号または数値が本発明範囲外

[0045]
[Table 4]

表 4 [塗料組成物]

No.	ベース樹脂		硬化剤 (1)		硬化剤 (2)		
	種類 *1	添加量 *2	種類 *3	添加量 *2	種類 *3	添加量 *2	*4
16	4	100	フェノール樹脂	20	—	—	—
17	4	100	フェノール樹脂	25	—	—	—
18	4	100	フェノール樹脂	30	—	—	—
19	4	100	フェノール樹脂	40	—	—	—
20	4	100	フェノール樹脂	50	—	—	—
21	4	100	メラミン樹脂A	15	—	—	—
22	4	100	メラミン樹脂B	15	—	—	—
23	4	100	ブロックイソシアネート	15	—	—	—
24	4	100	尿素樹脂	15	—	—	—
25	4	100	潜在性硬化剤	15	—	—	—
26	4	100	フェノール樹脂	5	潜在性硬化剤	0.1	2
27	4	100	フェノール樹脂	5	潜在性硬化剤	0.2	4
28	4	100	フェノール樹脂	5	潜在性硬化剤	0.5	10
29	4	100	フェノール樹脂	5	潜在性硬化剤	1.0	20
30	4	100	フェノール樹脂	5	潜在性硬化剤	5	100

*1：表1に記載のベース樹脂No.
*2：重量部（固形分）
*3：表2に記載の硬化剤の種類
*4：フェノール樹脂100重量部（固形分）に対する潜在性硬化剤の重量部（固形分）
注）下線を付した符号または数値が本発明範囲外

[0046]
[Table 5]
表 5 [塗料組成物]

No.	ベース樹脂		硬化剤 (1)		硬化剤 (2)		
	種類 *1	添加量 *2	種類 *3	添加量 *2	種類 *3	添加量 *2	*4
31	4	100	フェノール樹脂	5	潜在性硬化剤	10	200
32	4	100	フェノール樹脂	5	潜在性硬化剤	20	400
33	4	100	フェノール樹脂	15	潜在性硬化剤	0.5	3
34	4	100	フェノール樹脂	15	潜在性硬化剤	1.0	7
35	4	100	フェノール樹脂	15	潜在性硬化剤	2	13
36	4	100	フェノール樹脂	15	潜在性硬化剤	5	33
37	4	100	フェノール樹脂	15	潜在性硬化剤	10	67
38	アクリル樹脂エマルジョン						
39	ウレタン樹脂エマルジョン						

*1：表1に記載のベース樹脂No.
*2：重量部（固形分）
*3：表2に記載の硬化剤の種類
*4：フェノール樹脂100重量部（固形分）に対する潜在性硬化剤の重量部（固形分）
注）下線を付した符号または数値が本発明範囲外

[0047]
[Table 6]

表 6

No.	塗料組成物 *1	膜厚 *2	焼付温度 *3	常温接着強度	高温接着強度	耐ブロッキング性	耐食性	区 分
1	1	6	200	○	△	×	△	比較例
2	2	6	200	○	△	○	○	本発明例
3	3	6	200	○+	○+	○	◎	本発明例
4	4	6	200	○+	○+	○	◎	本発明例
5	5	6	200	○+	○+	○	◎	本発明例
6	6	6	200	○+	○+	○	◎	本発明例
7	7	6	200	○+	○	○	○	本発明例
8	8	6	200	○	○	○	○	本発明例
9	9	6	200	△	△	○	△	比較例
10	10	6	200	○+	○+	○	○	本発明例
11	11	6	200	△	×	○	△	比較例
12	12	6	200	◎	△	○	○	本発明例
13	13	6	200	◎	△	○	○	本発明例
14	14	6	200	◎	○	○	◎	本発明例
15	15	6	200	○+	○+	○	◎	本発明例
16	16	6	200	○+	○+	○	◎	本発明例
17	17	6	200	○+	○+	○	◎	本発明例
18	18	6	200	○	○	○	◎	本発明例

*1：表３～表５に記載の塗料組成物No.
*2：乾燥後膜厚（μm）
*3：到達板温（℃）（昇温速度30℃／sec）
注）下線を付した符号または数値が本発明範囲外

[0048]
[Table 7]
表 7

No.	塗料組成物 *1	膜厚 *2	焼付温度 *3	常温接着強度	高温接着強度	耐ブロッキング性	耐食性	区 分
19	19	6	200	○	○	○	◎	本発明例
20	20	6	200	△	×	○	△	比較例
21	21	6	200	○+	○	○	○	本発明例
22	22	6	200	○+	○	○	○	本発明例
23	23	6	200	○	△	○	○	本発明例
24	24	6	200	○	△	○	○	本発明例
25	25	6	200	○	△	○	○	本発明例
26	26	6	200	◎	○+	○	◎	本発明例
27	27	6	200	◎	◎	○	◎	本発明例
28	28	6	200	◎	◎	○	◎	本発明例
29	29	6	200	◎	◎	○	◎	本発明例
30	30	6	200	◎	◎	○	◎	本発明例
31	31	6	200	◎	○+	○	◎	本発明例
32	32	6	200	◎	○	○	○	本発明例
33	33	6	200	◎	◎	○	◎	本発明例
34	34	6	200	◎	◎	○	◎	本発明例
35	35	6	200	◎	◎	○	◎	本発明例
36	36	6	200	◎	◎	○	◎	本発明例

*1：表３～表５に記載の塗料組成物No.
*2：乾燥後膜厚（μm）
*3：到達板温（℃）（昇温速度30℃／sec）
注）下線を付した符号または数値が本発明範囲外

[0049]

[Table 8]
表 8

No.	塗料組成物 *1	膜厚 *2	焼付温度 *3	常温接着強度	高温接着強度	耐ブロッキング性	耐食性	区 分
37	37	6	200	◎	◎	○	◎	本発明例
38	38	6	200	○	×	○	○	比較例
39	39	6	200	○	×	○	○	比較例
40	34	0.5	200	×	×	○	△	比較例
41	34	1.5	200	○	△	○	○	本発明例
42	34	3	200	○+	○+	○	○	本発明例
43	34	4	200	◎	◎	○	◎	本発明例
44	34	5	200	◎	◎	○	◎	本発明例
45	34	7	200	◎	◎	○	◎	本発明例
46	34	8	200	◎	◎	○	◎	本発明例
47	34	10	200	◎	◎	○	◎	本発明例
48	34	6	90	◎	◎	×	×	比較例
49	34	6	100	◎	◎	○	△	本発明例
50	34	6	130	◎	◎	○	○	本発明例
51	34	6	150	◎	◎	○	◎	本発明例
52	34	6	230	◎	◎	○	◎	本発明例
53	34	6	300	○	△	○	◎	本発明例
54	34	6	350	×	×	○	◎	比較例

*1：表３～表５に記載の塗料組成物No.
*2：乾燥後膜厚（μm）
*3：到達板温（℃）（昇温速度30℃／sec）
注）下線を付した符号または数値が本発明範囲外

[0050]
[Table 9]
表 9

No.	塗料組成物 *1	膜厚 *2	焼付温度 *3	常温接着強度	高温接着強度	耐ブロッキング性	耐食性	区 分
55	4	1	200	×	×	○	△	比較例
56	4	2	200	○	△	○	○	本発明例
57	4	3	200	○+	○+	○	○	本発明例
58	4	4	200	○+	○+	○	◎	本発明例
59	4	5	200	○+	○+	○	◎	本発明例
60	4	7	200	○+	○+	○	◎	本発明例
61	4	6	100	◎	◎	○	△	本発明例
62	4	6	130	◎	◎	○	○	本発明例
63	4	6	150	◎	◎	○	◎	本発明例
64	4	6	230	○+	○+	○	◎	本発明例
65	4	6	300	○	△	○	◎	本発明例
66	4	6	350	×	×	○	◎	比較例
67	1	6	100	○	○	×	×	比較例
68	2	6	100	○+	○+	○	△	本発明例
69	3	6	100	◎	◎	○	△	本発明例
70	6	6	100	◎	◎	○	△	本発明例
71	7	6	100	○+	○	○	△	本発明例
72	8	6	100	○	△	○	△	本発明例

*1：表３～表５に記載の塗料組成物No.
*2：乾燥後膜厚（μm）
*3：到達板温（℃）（昇温速度30℃／sec）
注）下線を付した符号または数値が本発明範囲外

[0051]
[Table 10]
表 10

No.	塗料組成物 *1	膜厚 *2	焼付温度 *3	常温接着強度	高温接着強度	耐ブロッキング性	耐食性	区 分
73	9	6	100	△	×	○	×	比 較 例
74	1	6	300	△	△	×	△	比 較 例
75	2	6	300	○	△	○	○	本発明例
76	3	6	300	○	△	○	◎	本発明例
77	6	6	300	○	△	○	◎	本発明例
78	7	6	300	○	△	○	◎	本発明例
79	8	6	300	△	△	○	◎	本発明例
80	9	6	300	×	×	○	◎	比 較 例
81	1	10	200	○+	○	×	△	比 較 例
82	2	10	200	○+	○+	○	○	本発明例
83	3	10	200	◎	◎	○	◎	本発明例
84	4	10	200	◎	◎	○	◎	本発明例
85	6	10	200	◎	◎	○	◎	本発明例
86	7	10	200	◎	○+	○	○	本発明例
87	8	10	200	○+	○+	○	○	本発明例
88	9	10	200	△	△	○	△	比 較 例

*1：表３～表５に記載の塗料組成物No.
*2：乾燥後膜厚（μm）
*3：到達板温（℃）（昇温速度30℃／sec）
注）下線を付した符号または数値が本発明範囲外

[0052]
[Effect of the Invention] As stated above, the bond strength which was stabilized also under the operating environment (ordinary temperature - elevated temperature) of a motor or a transformer according to this invention is obtained, and the magnetic steel sheet for adhesion iron cores which has the bonded type insulation coat which was moreover excellent also in blocking resistance and corrosion resistance can be manufactured.

[Translation done.]